Charles Wright's time, Dr. Britton exhibited many interesting herbarium specimens secured on the recent expedition to that island.

He also reviewed the literature relating to the Cuban flora, after which discussion followed.

Adjourned.

Percy Wilson,
Secretary

OF INTEREST TO TEACHERS

Some Reflections upon Botanical Education in America

By W. F. Ganong

In a word the first great need of our science teaching is to make it scientific.

The second of the four principal causes of our inferior teaching is this, *we take more thought for our subject than we do of our students.* In the graduate teaching of a university this attitude is logical, but in college and school it is wholly wrong. I think we may express the matter thus, that any teacher who is more interested in his subject than in his students is fit only for a university. It is, I am sure, somewhat more characteristic of scientific than of other teachers that they tend to shut themselves up in their subjects, and to withdraw more than they ought from the common interests, duties and even amenities of the communities in which they live. For this, of course, the very attractiveness of science is largely responsible, because to those who have once passed the portals, science offers an interest so vastly and profoundly absorbing that all other matters appear small by comparison; and we are apt to conclude that the nobility and beneficence of such a mistress are sufficient justification for a complete immersion in her service. We forget that science has no existence apart from humanity, and no meaning unless contributory, however indirectly, to human welfare and happiness. And it should be emphasized to every young teacher that success in science teaching, as in so many other occupations, is well-nigh in direct proportion to one's ability to influence people. Our science teaching would be better if our teachers trusted less to the abounding merits of their subjects, and more to the qualities which personally influence young people — the sympathetic qualities involving interest in their pursuits, the diplomatic qualities involving the utilization for good purposes of the peculiarities of human nature, the perfecting qualities involving the amenities and even the graces of life. There is no inconsistency between these things and the preservation of the scientific quality of the teaching. It is simply a question of the presentation of science in a manner which is humanistic. It is the gloving of the iron hand of the scientific method by the soft velvet of gentle human intercourse. Science is the skeleton of knowledge, but it need lose nothing of its strength and flexibility if clothed by a living mantle of the human graces. It is idealism with realism which is demanded of the science teacher, and if some one would rise to say that this union is logically impossible I would answer, that many a problem of this life unsolvable by the subtleties of logic can be settled by robust common sense.

Of our over-neglect of the personal peculiarities of our students I know several illustrations, but have space only for one. Young people appear to have in them some measure of Nägeli's innate perfecting principle, which leads them upon the whole to respect and like those things which are good and clean and dignified, a feeling which manifests itself in their strivings after good clothes, good society and things supposedly artistic, not to mention innumerable longings after the lofty unattainable. Now a dirty or carelessly-managed laboratory is a direct shock to this feeling, and most scientific laboratories sin in these features. I believe there is no part of a college or school equipment which ought to be prepared and managed with more care than a scientific laboratory. Efficiency for its purpose is of course the first requisite of any laboratory, but in college or high school that efficiency should be secured with attention to the utmost of pleasing effect, in the direction of a large simplicity, evidence of care for each feature, and an atmosphere of spacious and even artistic deliberation. As an example of what can be done by good taste to give a pleasing setting to the most unpromising objects, I commend the New

York Zoological Park, which embodies an idea much needed in most of our botanical institutions. We ought not to permit the accumulation of dusty and disused articles around laboratories any more than around libraries; our teaching museums should contain no crowded accumulations of half-spoiled specimens in leaky green bottles, but only a selection of the most important, and those in the best of receptacles well labeled and tastefully displayed. Our experiments with plants should not exhibit dirty pots on untidy tables, but every plant should present an aspect suggestive of considerate care, while all the surrounding appliances should glitter with cleanness and stand on a spotless table widely enmargined with space and neatness. One of my friends in a neighboring college has said of the methods of my laboratory that they savor of the old maid. I take pride in this compliment, for it shows I am advancing. All of these qualities of care, neatness, concentration upon a few large and worthy things, can be made to appeal greatly to youth, as I have learned from experience. Besides, they are scientific, and they are right.

There is yet one other phase of this subject of humanism in science teaching which I wish to emphasize. I think we do not make enough use in our teaching of the heroic and dramatic phases of our science, of the biography of our great men and the striking incidents of our scientific history. I know that their use is attended with dangers, dangers of false sentimentalism, of substitution of weak imagery for strong fact, of complication with religious prejudices; and they should therefore be introduced only as the teacher grows wiser. But when the tactful teacher can employ them to touch the higher emotions of his students, he should do so. The imagination is as necessary a part of the equipment of the man of science as of the man of letters or of art, a matter which has been illuminated with all his usual skill by President Eliot in his great address on the new definition of the cultivated man. When Darwin wrote his famous passage on the loss of his esthetic faculties he was a little unfair to his science and a good deal unfair to himself. For he never mentioned the compensation he had found in the intensity of lofty pleasure derived from his acquisition of new truth. Science hath her exaltations no less than poetry, music, art or religion. Not only is the feeling of elation which comes to the scientific investigator with the dawning of new truth just as keen, just as lofty just as uplifting as that given by any poetry, any music, any art, any religous fervor, but they are, in my opinion, the same in kind. There is but one music heard by the spirit, and that is in us, whether it seem to come from the spheres, from the lyres of the muses, or from the voices of angels, and it gives forth when the last supremest chord in the soul of man is touched, it matters not by what hand.

We come now to the third of the causes which make our teaching of science defective, and it is this — *we put our trust too much in systems and not enough in persons.* And of this there are many evidences. For one thing we rely too much on a supposed virtue in buildings and equipment, though in this we but share the spirit of our machinery-mad day and generation. It is much easier for us Americans to obtain great laboratories and fine equipment than to make good use of them afterwards, and nowhere among us do I see any signs of a Spartan pride in attaining great results with a meager equipment. Moreover, we make a deficiency of equipment an excuse for doing nothing. As one of the most brilliant of American botanists once said, some persons think they can do nothing in the laboratory unless provided with an array of staining fluids which would make the rainbow blush for its poverty. A second evidence of our confidence in systems is found in the easy insouciance with which university professors proceed to write text-books for high schools. The only qualification the most of them have therefor is a knowledge of their subject, and they seem to regard any personal acquaintance with the peculiarities of young people, and with the special conditions of high school work, as comparatively negligible. In consequence these books are necessarily addressed to some kind of idealized student, usually a bright-eyed individual thirsting for knowledge. This kind does exist, but in minority, whereas the real student with which the high school must deal is one of a great mass willing to learn if it must. Confirmation of the correctness of my view that knowledge of students is as important as knowledge of subject for the writing of a high school book is found in the fact that the author of the botanical text-books most widely used in the high schools of this country has had only a high school experience. Another phase of our belief in the sufficiency of systems is found in the utterly unpractical character of many of the exercises or experiments proposed for the student in some of our books. These recommendations have obviously been worked out in the comfort of the study chair, and have never been actually tested in use by their suggestors; yet they are presented in a way to make the student feel that he is either negligent or stupid if he fails to work them. These theoretically constructed schemes for elementary teaching, and these recommendations of untried and impracticable tasks for students, sometimes run riot in company with sweeping denunciations of our present laboratory courses, and suggestions for their replacement by hypothetical field courses, utterly regardless of the fact that the former, whatever their faults, have been evolved in actual administrative adaptation to the real conditions of elementary work, while the proposed substitutes are wholly untried, and in the light of actual conditions, wholly impracticable.

On the other hand, there is one particular in which we have not system enough, and that is in the standardization of nature study and elementary science courses. I have already mentioned the advantage the humanities have in the approximate standardization of their instruction throughout the educational system, and towards this end for the sciences we ought to bend every effort. For one thing we should give all possible aid and comfort to our nature-study experts in their efforts to develop a worthy system of nature study in the grades. Again, the peculiar relation of preparatory schools to colleges in this country makes it imperative that we develop standard elementary courses which any school can give with assurance that they will be accepted for entrance to any college. Happily we are here upon firm ground, for we already possess such a standard course, or unit, in that formulated by a committee of botanical teachers, now the committee on education of this society. This course is formulated upon the synthetic principle, that is, it selects the most fundamental and illuminating matters offered by the science without regard to its artificial divisions, and combines these in such manner as to make them throw most light upon one another. Its adaptability to our conditions, and its acceptability to our best educational opinion, is shown by several facts, by its adoption as the unit by the college entrance examination board which has been holding examinations upon it all over the country for six years past, by its use in innumerable high schools, by the agreement between its plan and that of all of the recent and successful text-books, by the final disappearance of all influential opposition to it, and lastly by the substantial concurrence of the unit now in formulation by the teachers of the middle west. With so firm a foundation in a plan we ought to be able to unite on perfecting details. There is no inconsistency between such standardization as this and the greatest freedom in teaching. The optical power of the microscope has not been injured by the standardization of its form and screwthreads.

(*To be continued*)

The April *Bulletin of the Torrey Botanical Club* contains an illustrated paper by Philip Dowell on the violets of Staten Island, with a simple key and named habits of all the island forms. Thirty hybrids are also named or described.

The Russian Agricultural Commission has a representative here studying the hardier American fruits and agricultural methods and machinery, with a view to introducing them into the Russian steppes; two representatives from Denmark — one from an agricultural college and one from an experiment station — are investigating our production and pathological treatment of forage crops.

A paper read at the Boston meeting of the American Association for the Advancement of Science showed the effect of various gases on sweet pea seedlings (inhibition of growth, swelling of the growing region, and horizontal placing of the stem). The authors, Knight, Rose, and Crocker suggest the use of these seedlings in detecting traces of illuminating gas, it being well known that gas leakage (in amounts too small for the usual chemical tests) often causes large losses to florists, especially in producing the "sleep" of carnations.

Science (May 6) in the botanical notes mentions an archaic type of seed from the Palaeozoic rocks which was first discovered in 1875 in England by Professor Williamson. It is 5–6 millimeters long and ribbed; the ten ribs forming so many separate arms which project beyond the nucellus for a considerable distance. The plants which bore these seeds have not been found; but Professor F. W. Oliver who described them (*Annals of Botany*, Jan., 1909) thinks the plants belong to the Cycadofilices, and that the seed is "the most primitive seed that has yet come to light."

Under the caption "Children of the Land" the *Outlook* (April 23) recently described the great school garden movement in Canada. It is really much more than that, for through the munificence of Sir William MacDonald under the management of Dr. Robertson (formerly of MacDonald College) a systematized attempt is being made not only to "adjust the schools and train the children that the children will be attracted to rural occupations and will be qualified to remain in them," but to give "practical illustrations of how the occupation in each locality may be made more attractive, profitable, and satisfying to those engaged in farming."

Professor Ira D. Cardiff, at the winter meeting of the American Association for the Advancement of Science described some aberrant walnut fruits from two trees, one in Indiana and one in Tennessee. The fruits (see also the *Plant World* for April) have a walnut-like basal part, while the opposite part is smooth and four-furrowed, suggesting the hickory. In all the endocarp is walnut-like; the trees in general aspect, bark (except for some hickory characters in the Tennessee tree), and leaves are walnuts. Cross-pollination is not believed by Professor Cardiff to account for the conditions; in each case the nearest hickories are (now) 30 meters from the trees under discussion, and the hybrid (?) character of the fruit is found in "that portion of the nut produced by the parent sporophyte." A careful study is planned; it is thought that histological characters of the trees may indicate a cross.

The botanic garden papers read at the Boston meeting (A. A. A. S.) have been reprinted in *Science* (April 29, May 6,). In all the garden is discussed as a public institution, whether from the viewpoint of administration, rare plants, taxonomic completeness, or landscape effects. Professor Blakeslee's paper on the botanic garden as a field museum includes many suggestions, some of which feature in our better botanic gardens and which might be incorporated into many school gardens — even the small ones. A garden dictionary — and that of common things — is advocated rather than a "plant circus" where the curious may enter with the expectation of being surprised at oddities in nature and horticulture. Improvement under cultivation, plant diseases, and illustrations of heredity, variation, and hybrids (including even Mendel's law, failing to come true to seed, etc.) may be shown in odd corners of a school garden and with inexpensive material.

An interesting review of Researches on Fungi, by A. H. Reginald Buller, is given in *Science* (March 18) by Professor George F. Atkinson. The review includes brief mention of the geotropic curvature of the stem of certain mushrooms (in *Coprinus* an "overtilting or supracurvature four times before it came to rest in the perpendicular position") ; the adjustment of the pileus in a horizontal position by the negatively geotropic stem, and the finer adjustment of the gills by their positive geotropism ; the immense numbers of spores produced by single individuals (varying from 2,000,000,000 in *Agaricus campestris* to 7,000,000,000,000,000 in *Lycoperdon giganteum ;* the enormous spore waste, (in *Polyporus squamosus*, about one spore in a trillion has a "chance of starting a new successful cycle) ; the resuming of spore ejaculation by many of the xerophytic fungi which have been preserved dry for months or even years ; and autodigestion of regions of the inky caps *following* spore dissemination, the spores being, it is held, anemophilous, and not mixed with the inky liquid and spread by insects.